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EXAMINER

KIM, PAUL

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/673,733
Filing Date: September 29, 2003
Appellant(s): HAYARDENY ET AL.

Suzanne Erez
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 9 February 2009 appealing from the Office action mailed 19 August 2008.

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(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

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(8) Evidence Relied Upon

5,742,792	Yanai et al	05-1996
2004/0267836	Armangau et al	06-2003
6,269,431	Dunham	08-1998

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claims 1-12 and 19-20** are rejected under 35 U.S.C. 103(a) as being unpatentable over Yanai et al (U.S. Patent No. 5,742,792, hereinafter referred to as Yanai), filed on 28 May 1996, and issued on 21 April 1998, in view of Armangau et al (USPGPUB No. 2004/0267836, hereinafter referred to as ARMANGAU), filed on 25 June 2003, and published on 30 December 2004.

3. **As per independent claims 1 and 10**, Yanai, in combination with Armangau, discloses:

A method for managing a data storage system that includes primary and secondary storage subsystems, including respective first and second non-volatile storage media, the method comprising:

maintaining a record on the secondary storage subsystem, which is predictive of locations to which data are to be written on the primary storage subsystem by a host processor {See Yanai, C11:L15-30, wherein this reads over "the present system maintains a list or index, utilizing one or more flag bits, in a hierarchical structure, on each physical and logical data storage device" and "each data storage system maintains an indication of write or copy pending 102 of both the primary data (M1) 104, and the secondary data (M2)"; and C12:L6-7, wherein this reads over "each data storage device keeps data validity information about its mirrored device}, the record including a designation of locations to which the host is expected to write in the near future;

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receiving at the primary storage subsystem, from the host processor, the data to be written to a specified location on the first non-volatile storage media *{See Yanai, C11:L31-34, wherein this reads over "when a host computer writes data to a primary data storage system, it sets both the primary and secondary bits 104, 106 of the write pending bits 102 when data is written to cache"};*

making a determination that the specified location is not included in the record, and responsively to the determination sending a message from the primary storage subsystem to the secondary storage subsystem so as to cause the secondary storage subsystem to update the record *{See Yanai, C12:L6-21, wherein this reads over "every new write command goes to the accessible mirrored device along with information that the not accessible device has a track which is not valid" and "when a specific track is not shown on both the primary and secondary storage system, an indication of such will be assigned"};*

wherein sending the message causes the secondary storage subsystem to predict one or more further locations to which the host processor has not yet written the data and is expected to write the data in a subsequent write operation, and to set a number of predicted locations in the record corresponding to the one or more further locations *{See ARMANGAU, Para. [0099], wherein this reads over "[i]f the corresponding bit in the old bit map indicates a modified block in the primary file system volume not yet copied to the save volume, that it is copied on a prior basis to the save volume"; and Para. [0243], wherein this reads over "a meta bit map having a bit for indicating whether or not each allocated block of storage in the production file system is valid or not" and "a corresponding meta bit map is allocated or extended, and the bits in the meta bit map corresponding to the newly allocated storage are initially reset"};*

signaling the host processor that the data have been stored in the data storage system responsively to receiving the data and, when the specified location was not included in the record, responsively to receiving an acknowledgment at the primary storage subsystem from the secondary storage subsystem indicating that the record has been updated *{See Yanai, C15:L36-43, wherein this reads over "[t]he data storage system containing the primary (R1) volume informs the host that an I/O sequence has successfully completed only after the data storage system containing the secondary (R2) volume acknowledges that it has received and checked the data"};* and

storing the data in the specified location on both the first and second non-volatile storage media *{See Yanai, C11:L37-43, wherein this reads over "[w]hen the primary data storage system controller's disk adapter writes the data to the primary data storage device" and "[o]nce the secondary data storage system has written the data"};*

While Yanai may fail to expressly disclose the use of bits and bitmap records in managing a data storage system, it is noted that Armangau discloses an invention wherein bits and bitmaps are used in allocating space within a data storage. The allocated data storage space is then held so that a subsequent write operation may write data in said allocated data storage space. Thus, it would have been obvious to one of ordinary skill in the art to modify the invention as disclosed by Yanai with the invention as disclosed by Armangau.

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One of ordinary skill in the art would have been motivated to make this modification so that free locations within a storage subsystem may be held for a subsequent write operation to said location.

4. **As per dependent claim 2**, Yanai, in combination with Armangau, discloses:

The method according to claim 1, wherein sending the message comprises copying the data synchronously from the primary storage subsystem to the secondary storage subsystem *{See Yanai, C15:L36-39, wherein this reads over "data on the primary (R1) and secondary (R2) volumes are always fully synchronized at the completion of an I/O sequence"}*.

5. **As per dependent claim 3**, Yanai, in combination with Armangau, discloses:

The method according to claim 2, wherein storing the data comprises, upon making the determination that the specified location is included in the record, copying the data from the primary storage subsystem to the secondary storage subsystem asynchronously, without updating the record with respect to the specified location *{See Yanai, C2:L58-65, wherein this reads over "asynchronously with the primary host computer requesting the writing of data to the primary data storage system"}*.

6. **As per dependent claim 4**, Yanai, in combination with Armangau, discloses:

The method according to claim 3, wherein copying the data comprises transmitting the data between mutually-remote sites over a communication link between the sites *{See Yanai, C5:L16-20, wherein this reads over "the remote mirroring facility is provided with a migration mode which is active during host processing of a primary (R1) volume and iteratively copies updates from the primary (R1) volume to a secondary (R2) volume"}*.

7. **As per dependent claim 5**, Yanai, in combination with Armangau, discloses:

The method according to claim 3, wherein maintaining the record comprises maintaining a copy of the record on the primary storage subsystem, and wherein signaling the host processor comprises, upon making the determination that the specified location is included in the record, indicating to the host processor that the data have been stored without waiting to receive the acknowledgment from the secondary storage subsystem *{See Yanai, C3:L43-48, wherein this reads over "[t]he data storage system containing the primary (r1) volume informs the host that an I/O sequence has successfully completed without waiting for the data storage system containing the secondary (R2) volume to acknowledge that it has received and checked the data"}*.

8. **As per dependent claim 6**, Yanai, in combination with Armangau, discloses:

The method according to claim 1, wherein copying the data comprises creating a mirror on the secondary storage subsystem of the data received by the primary storage subsystem *{See Yanai, C58-65, wherein this reads over "the remote data copying or mirroring is completely independent of and transparent to the host computer system"}*.

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9. **As per dependent claim 7**, Yanai, in combination with Armangau, discloses:

The method according to claim 6, and comprising, upon occurrence of a failure in the primary storage subsystem, configuring the secondary storage subsystem to serve as the primary storage subsystem so as to receive further data from the host processor to be stored by the data storage system *{See Yanai, C17:L39-44, wherein this reads over "Under the abnormal condition of the data being entirely absent from the data storage system due to a disk drive failure, however, a request for data access to a primary (R1) volume can be satisfied by obtaining the requested data from the secondary volume (R2) in the remote data storage system"}*.

10. **As per dependent claim 8**, Yanai, in combination with Armangau, discloses:

The method according to claim 6, and comprising, upon recovery of the system from a failure of the primary storage subsystem, conveying, responsively to the record, a portion of the data from the secondary storage subsystem to the primary storage subsystem for storage on the primary storage subsystem *{See Yanai, C27:L56-59, wherein this reads over "[w]hen the defective disk device is replaced, the data storage system re-synchronizes the mirrored pair, automatically copying data to the new disk"}*.

11. **As per dependent claim 9**, Yanai, in combination with Armangau, discloses:

The method according to claim 1, wherein maintaining and updating the record comprise marking respective bits in a bitmap corresponding to the locations to which the data are to be written on the first and second non-volatile storage media *{See Yanai, C35:L22-61}*.

12. **As per dependent claim 11**, Yanai, in combination with Armangau, discloses:

The method according to claim 10, wherein sending the message comprises modifying both the record and the copy of the record responsively to the specified location *{See Yanai, C11:L31-43, wherein this reads over "When the primary data storage system controller's disk adapter writes the data to the primary data storage device, it will reset bit 104 of the write pending indicator bits 102. Similarly, once the secondary data storage system has written the data to the secondary data storage device, the secondary data storage write pending indicator bit 106 will be reset"}*.

13. **As per dependent claim 12**, Yanai, in combination with Armangau, discloses:

The method according to claim 11, wherein modifying both the record and the copy of the record comprises adding a plurality of locations, including the specified location, to both the record and the copy of the record *{See Yanai, C11:L31-35, wherein this reads over "when a host computer writes data to a primary data storage system, it sets both the primary and secondary bits 104, 106 of the write pending bits 102 when data is written to cache"}*.

14. **As per dependent claim 18**, Yanai, in combination with Armangau, discloses:

The method according to claim 1, wherein sending the message causes the secondary storage subsystem to designate one or more further locations to which the host processor is expected to write the data in a subsequent write operation, and to add the one or more further locations to the record *{See Yanai, C25:L16-61}*.

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15. **As per dependent claim 19**, Yanai, in combination with Armangau, discloses:

The method according to claim 18, wherein the one or more further locations comprise a predetermined number of consecutive locations in proximity to the specified location *{See Yanai, C40:L3-5, wherein this reads over "The preferred format for the information in the link buffer 505 is a string of track and record identifications and indications of where the records are found in the cache 228"}.*

16. **As per dependent claim 20**, Yanai, in combination with Armangau, discloses:

The method according to claim 18, wherein maintaining the record comprises recording the locations to which the data are written using an object-based storage technique, and wherein the one or more further locations are chosen based on a logical connection between storage objects *{See Yanai, C3:L25-29, wherein this reads over "The operating mode for each logical volume can be specified to best suit the purposes of the desired remote mirroring, the particular application using the volume, and the particular use of the data stored on the volume"}.*

17. **Claims 13-14** are rejected under 35 U.S.C. 103(a) as being unpatentable over Yanai, in view of Armangau, and in further view of Dunham (U.S. Patent No. 6,269,431), filed on 13 August 1998, and issued on 31 July 2001.

18. **As per dependent claim 13**, Yanai, as modified by Armangau and Dunham, discloses:

The method according to claim 10, wherein maintaining the copy of the record comprises selecting one or more locations, other than the specified location, to be removed from the record, and instructing the secondary storage subsystem to remove the one or more locations from the record, so as to limit a size of the record *{See DUNHAM, C17:L67-C18:L4, wherein this reads over "[u]pon completion of a file deletion command, the secondary data storage subsystem would return an acknowledgment to the host, and the host could update its catalog to reflect deletion of the files from the back-up version of the file system"}.*

While Yanai may fail to expressly disclose the instructing of the second storage subsystem to remove locations from a record, the combination of inventions disclosed in Yanai and Dunham would disclose an invention which removed one or more locations from the record. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by Yanai by combining it with the invention disclosed by Dunham.

One of ordinary skill in the art would have been motivated to do this modification so that the size of the record may be limited by archiving and purging unnecessary entries from the record. In addition, Yanai and Dunham are analogous art because they belong to the same field of endeavor, such as, back

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up and mirroring data between a plurality of storage devices, memory allocation, and database management systems.

19. **As per dependent claim 14**, Yanai, as modified by Armangau and Dunham, discloses:

The method according to claim 13, wherein storing the data comprises copying the data to be stored in the one or more locations from the primary storage subsystem to the secondary storage subsystem *{See Yanai, C1:L30-38, wherein this reads over "the copying of the primary data to a secondary data storage system controller which forms part of a secondary data storage system"}, and*

wherein selecting the one or more locations comprises receiving a return message from the secondary storage subsystem indicating that the secondary storage subsystem has received the copied data *{See Yanai, C15:L36-43, wherein this reads over "[t]he data storage system containing the primary (R1) volume informs the host that an I/O sequence has successfully completed only after the data storage system containing the secondary (R2) volume acknowledges that it has received and checked the data"}, and*

selecting the one or more locations to be removed from the record responsively to the return message *{See DUNHAM, C17:L38-C18-24, wherein this reads over "[t]he procedure, for example, deletes files of the file system that have expired or that a user or application program did not request to be backed up" and "the back-end data mover updates the secondary directory to refer to the new, compacted file system and thereby delete the original backup version of the file system"}*.

While Yanai may fail to expressly disclose the selection of locations to be removed from the record responsively to the return message, the combination of inventions disclosed in Yanai and Dunham would disclose an invention which selected one or more locations from the record for removal.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by Yanai by combining it with the invention disclosed by Dunham.

One of ordinary skill in the art would have been motivated to do this modification so that the size of the record may be limited by archiving and purging selected entries from the record. In addition, Yanai and Dunham are analogous art because they belong to the same field of endeavor, such as, back up and mirroring data between a plurality of storage devices, memory allocation, and database management systems.

20. **Claims 15-17** are rejected under 35 U.S.C. 103(a) as being unpatentable over Yanai, in view of Armangau, in view of Dunham, and in further view of Official Notice.

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21. **As per dependent claim 15**, the Examiner takes Official Notice that it would have been obvious to one of ordinary skill in the art at the time the invention was made to identify locations containing identical data since multiple copies of identical data need not be stored in multiple locations. Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to remove the location which was least-recently added so that the least-current location containing the identical data may be discarded.

22. **As per dependent claim 16**, the Examiner takes Official Notice that it would have been obvious to one of ordinary skill in the art at the time the invention was made to group the entries added to the copy of the record and the record in generations so that the generations, or versions, of entries may be used in discarding entries of a certain generation or version using a batch method.

23. **As per dependent claim 17**, the Examiner takes Official Notice that it would have been obvious to one of ordinary skill in the art at the time the invention was made to append an instruction to the message sent from the primary storage subsystem to the secondary storage subsystem, so that the appended instruction may be used in providing the secondary storage subsystem with the instructions to remove the locations.

(10) Response to Argument

a. Claim Rejections under 35 U.S.C. 103 – Claims 1 and 10

Appellant asserts the argument that "there is nothing in Yanai's record that is even remotely predictive of locations to which a host is expect to write in the near future." See Appeal Brief, page 8. The Examiner respectfully disagrees. The prior art reference of Yanai discloses a system wherein a primary data storage system and a secondary data storage system are synchronized either synchronously (i.e. real time) or asynchronously (i.e. point in time). In asynchronous mode, a log file of pending data which has yet to be written to a data storage device may be maintained on either the primary or secondary data storage system. See Yanai et al, col. 10, lines 49-57. Within said log file, an index or list of various criteria, such as a listing of

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data which has not been mirrored or copied and a list of invalid data storage device locations or tracks, is maintained. Accordingly, wherein the log file (i.e. the record) maintains an index of data which has not been mirrored or copied (i.e. data to be written) and a list of invalid data storage device locations or tracks (i.e. predictive locations to which data may be written through the exclusion of invalid locations), it would have been obvious to one of ordinary skill in the art that Yanai would indeed disclose the limitation of "maintaining a record on the secondary storage subsystem, which is predictive of locations to which data are to be written on the primary storage subsystem by a host processor."

Additionally, Appellant asserts the argument that Armangau fail to "relate any sort of record at all of locations of host writes." See Appeal Brief, page 8. The Examiner respectfully disagrees. The prior art reference of Armangau discloses a system wherein a snapshot copy facility maintains a plurality of snapshot copies such that modifications and updates to the snapshot copies are logged and synchronized between a primary file system and a secondary file system. See Armangau, [0099]-[0101]. Furthermore, it is noted that Armangau discloses a meta bit map wherein bits are use to indicate "whether or not each allocated block of storage in the production system is valid or not." See Armangau, [0243]. Accordingly, wherein Armangau discloses a meta bit map wherein valid locations for write access are indicated (i.e. a number of predicted locations in the record), it would have been obvious to one of ordinary skill in the art that Armangau would indeed disclose the limitation of "setting a number of predicted locations in the record corresponding to the one or more further locations."

Lastly, Appellant asserts the argument that "[t]he indication of 'validity' provided by the meta bit map therefore has nothing to do with either writing or prediction." See Appeal Brief, page 9. The Examiner respectfully disagrees in that Armangau discloses that if the original contents are invalid and therefore need not be saved, a write operation to the invalid block may be executed immediately. See Armangau, [0241]-[0242]. Accordingly, it is noted that the

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disclosed meta bit map is indeed directly related to the write process and prediction of data contents.

For the aforementioned reasons above, the rejection of claims 1 and 10 under 35 U.S.C. 103 are maintained.

b. Claim Rejections under 35 U.S.C. 103 – Claim 3

Appellant asserts the argument that “a primary storage subsystem might itself, decide for each write location specified by the host, whether to copy the data synchronously or asynchronously, depending on a record that the primary storage subsystem itself maintains and updates.” See Appeal Brief, page 11. The Examiner respectfully disagrees. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a primary storage subsystem might itself, decide for each write location specified by the host, whether to copy the data synchronously or asynchronously) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). It is noted that claim 3 simply recites a limitation wherein “upon making the determination that the specified location is included in the record, copying the data from the primary storage subsystem to the secondary storage subsystem asynchronously” and fails to recite the feature wherein a determination is made as to whether the update should be performed synchronously or asynchronously.

For the aforementioned reasons above, the rejection of claim 3 under 35 U.S.C. 103 is maintained.

c. Claim Rejections under 35 U.S.C. 103 – Claim 5

Appellant asserts the argument that Yanai fails to disclose that “a primary storage subsystem might consult some record of storage locations, and decide on the basis of this record when to acknowledge the host write without waiting for acknowledgment from the secondary

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storage subsystem." See Appeal Brief, page 12. The Examiner respectfully disagrees. For purposes of clarification, the Examiner notes that while Yanai discloses a semi-synchronous mode wherein remotely mirror volumes are always synchronized between the primary and secondary volumes initiating a next write operation, Yanai further discloses a synchronous mode wherein an acknowledgment is required prior performing a write function. Accordingly, Yanai does indeed disclose an invention wherein either a synchronous mode or a semi-synchronous mode (i.e. asynchronous) may be utilized in storing data.

For the aforementioned reasons above, the rejection of claim 5 under 35 U.S.C. 103 is maintained.

d. Claim Rejections under 35 U.S.C. 103 – Claim 12

Appellant asserts the argument that Yanai fails to disclose that "a plurality of bits, or a plurality of locations, should be set in both the primary and secondary records." See Appeal Brief, page 13. The Examiner respectfully disagrees. It is noted that Yanai discloses a system wherein invalid track bits on each data storage device may be checked to determine whether the track contains valid data. Additionally, it is noted that Armangau discloses a system wherein a meta bit map may be extended by adding bits corresponding to the newly allocated storage. Accordingly, wherein said bits are maintained in an index, it would have been obvious to one of ordinary skill in the art that the combination of Yanai and Armangau would disclose a system wherein bit related to tracks may be stored on a meta bit map such that invalid data blocks or tracks may be indexed accordingly.

For the aforementioned reasons above, the rejection of claim 12 under 35 U.S.C. 103 is maintained.

e. Claim Rejections under 35 U.S.C. 103 – Claim 16

In response to Appellant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so

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long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

The Examiner notes that for purposes of clarification that the grouping of entries added to the record have been construed as versions. That is, wherein the claim recites a generation of entries, it is noted that said generation of entries may read upon as versions of entries being made to the record. Furthermore, in response to Appellant's request for documentary evidence, the Examiner has provided the prior art of Menon et al (U.S. Patent No. 6,397,229). Menon et al discloses a method wherein bits of a bit map are set and cleared according to the backup status of the associated sector. See Menon et al, col. 4, line 40 - col. 5, line 6. Specifically, Menon et al discloses a system wherein a write operation to a sector results in the setting of a bit in the bit map. Thereafter, once the sector has been backed up to a tape drive, the bit indication associated with the sector is cleared. Accordingly, it would have been obvious to one of ordinary skill in the art the process of writing to a sector would result in the setting of a bit map (i.e. adding one or more entries to the record). Furthermore, said bits could be grouped and removed from the records when the sectors are backed up to the tape drive.

For the aforementioned reasons above, the rejection of claim 16 under 35 U.S.C. 103 is maintained.

f. Claim Rejections under 35 U.S.C. 103 – Claim 17

Appellant asserts the argument that "the use of the same message to cause the secondary storage subsystem to predictively add locations and to remove locations from the record is not in any way obvious." See Appeal Brief, page 15. The Examiner respectfully disagrees in that Menon et al discloses a method wherein a backup/write request for a sector is sent and processed, the bit associated with the sector is changed. Thereafter, once the sector is backed up onto a tape drive, the associated bit is cleared. Accordingly, one of ordinary skill in

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the art would have been able to discern that the backup/write request (i.e. the same message) would cause the secondary storage subsystem to predictively add and clear bits from the record.

For the aforementioned reasons above, the rejection of claim 17 under 35 U.S.C. 103 is maintained.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Paul Kim/

Paul Kim
Examiner, Art Unit 2169

Conferees:

/Tony Mahmoudi/
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